DOCUMENT RESUME

ED 161 710 SE 025 168

AUTHOR McLure, Gail T.; And Others
TITLE Women in Science and Technology: Careers for Today and Tomorrow.
INSTITUTION American Coll. Testing Program, Iowa City, Iowa.
PUB DATE 76
NOTE 20p.; Not available in hard copy due to copyright restrictions; Photographs may not reproduce well
AVAILABLE FROM ACT Publications, P.O. Box 168, Iowa City, Iowa 52240 ($1.50; Discounts on quantity orders)

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS *Career Opportunities; *Career Planning; Females; Higher Education; Occupational Choice; Science Careers; *Science Education; *Technology; *Vocational Counseling; *Womens Education
IDENTIFIERS American College Testing Program

ABSTRACT

This booklet explores the career opportunities for women in science and technology. It includes myths and realities about women in science and technology, characteristics of young female scientists and technologists, and steps women can take to plan a successful career. Numerous photographs of career women in science and technology, along with quotations or identifications are included. (MA)

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CAREERS FOR TODAY AND TOMORROW

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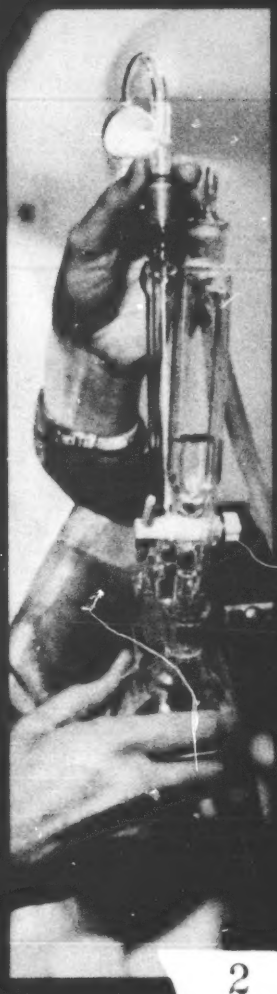

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ACT Publications
P.O. Box 168
Iowa City, Iowa 52240

(Check or money order must accompany request.) Price $1.50 Order No. 1-1-11.76

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Today's young woman can choose her career from a wider range of options than ever before. This booklet explores some of the growing career opportunities for women in science and technology.

The unidentified quotations used throughout this booklet come from a variety of women professionals and students in science and technology. They do not necessarily represent the views of the women pictured in the booklet.

This booklet was developed under the direction of Gail T. McLure with the assistance of Lois Renter and Ellen Piel. Patricia Gartland provided editorial assistance; Stan Haring was graphic designer. Mildred H. Lavin of The University of Iowa served as consultant.

Photo from **Women in Science** by Dinah Moché, distributed by the American Association of Physics Teachers

Gwendolyn Albert, environmental engineer in the U.S. Army Corps of Engineers, is currently working as a water supply specialist.

"If you like to create, to build, to discover, the world of science needs you badly."

"I think I was fortunate in not knowing how women measured themselves 'traditionally.' My mother and grandmother both had careers."

"If a high school girl is interested in a career in science, I would advise her to get into one of the summer science programs offered by some colleges and universities. These programs involve concentrated studies which give some idea of what a career in science may be like."

Photo by Radio Corporation of America

Lynne Darcy, chemist, works on synthesizing and studying the properties of materials used in electronic components.

Photo by the National Bureau of Standards

Lura Dunstan, analytical chemist at the National Bureau of Standards, works in a nearly contamination free room.

"Fully investigate the requirements of your chosen field by talking with people who hold jobs you think you would like."

"Today most women work for a substantial portion of their lives and should choose real careers, not just fill-in work."

Photo by National Bureau of Standards

Jackie Wise, chief of the National Bureau of Standards liquid-in-glass calibration laboratory, works on refinements in medical thermometry.

"Teaching and nursing are vitally important careers, but so are many others."

"Women are full partners in, and often leaders of, the various teams engaged in research and design. Their work may be in a laboratory, an office, a manufacturing plant, or on a construction site."

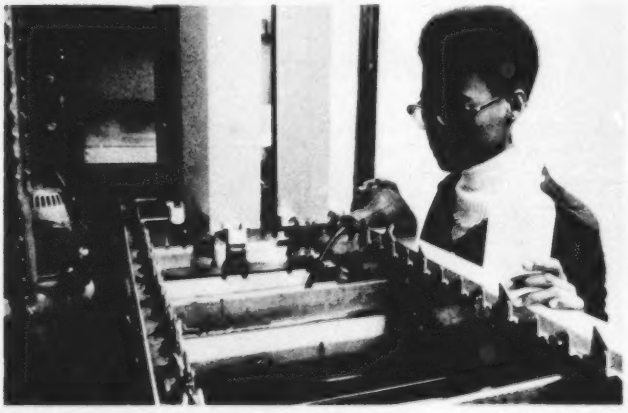

Photo by Kodak

Cheryl Black, chemical engineer, works in photographic technology to produce films, papers, and chemicals.

"Many women feel they aren't smart enough to get into a science/technology field, but who's to say that men are any smarter?"

"In the field of science, women are proving that their abilities can be as good or even better than those of men."

Photo by 3M Company

Kathy Sawicki, advanced design engineer, works in instrumentation and control systems.

"Engineering does not require more intelligence than any other profession, just a different set of aptitudes and interests."

"My problem was not in finding acceptance, but in finding out enough about engineering to become interested in the first place."

HAVE WE COME A LONG WAY?

Library of Congress, Prints and Photographs Division

Boys Learning Industrial Crafts; Girls Practicing Domestics

Before a woman can take a job as a scientist, an engineer, or a technologist, she must be trained for it. She must know that success is possible and that it makes sense to prepare for a career in science or technology.

In the past, schools have not properly prepared girls for such a future, have not encouraged them to consider careers in these areas. In some schools, girls have been barred from industrial arts classes and required to study home economics. Girls have not been encouraged to study math and science. Vocational-technical programs have typically enrolled mostly boys. Girls have been led to believe that careers in science and technology are only for boys.

But times are changing. Federal guidelines were released in 1975 to implement Title IX of the Education Amendments of 1972 prohibiting discrimination against females in schools. Affirmative action plans for school curriculums as well as for employment are being implemented in many places because of this legislation. There is a growing recognition that girls must have the whole range of educational and career options boys have always had.

WHY HAVEN'T MORE WOMEN CONSIDERED CAREERS IN SCIENCE AND TECHNOLOGY?

In the last few years, many books, articles, and conference speakers have suggested reasons why girls have not expected more of themselves in terms of a career and why they have limited themselves to traditionally female occupations. Here are a few of the hypotheses:

- Girls have not known that women are currently employed in a wide range of careers. They have lacked models of success.

- Stories and pictures in school materials have shown boys as strong, brave, competitive, clever leaders. Girls have been depicted as passive, dependent, clumsy, inadequate followers, and so have learned to think of themselves this way. Self images affect career expectations.

- Fewer characters in stories, especially main characters, are female.

- Classroom activities have often been assigned on the basis of sex. Boys have been expected to operate equipment, repair things, and assume leadership. Girls have had to settle for supporting roles, not as leaders but as helpers.

- Expectations of parents, teachers, and counselors have differed for boys and girls. Consequently, program and course selection has frequently been influenced by sex. Girls have not been encouraged to study and excel in math and science.

- Young women have not been encouraged to consider combining marriage and a career. For many, the prospect of marriage has interfered with career planning.

- The history of women's contributions to society has not been part of school curriculums. It has been largely ignored in the mass media.

YESTERDAY

Susie, do you want to be a nurse, a secretary, or a teacher?

Cartoons by Dave McLure

TOMORROW

Susie, what do you want to be? Accountant, airline pilot, architect, astronomer, biochemist, cartoonist, computer programmer, conductor, conservationist . . . .

. . . . motel manager, mason, mathematician, mechanical engineer, metallurgist, meteorologist, microbiologist, newscaster, nuclear physicist, nurse, oceanographer, ophthalmologist, . . . ?

WHAT ARE THE MYTHS AND THE REALITIES

MYTH	REALITY
"Some careers are more suitable for women than others."	Traditionally women have not been so free as men to choose a career. Social tradition and custom rather than actual unsuitability have kept them out of certain careers. In fact, in some foreign countries the percentages of women in science and technology careers are much higher than in the United States. Today, ideas about the roles of men and women are changing; jobs once closed to women are opening. Women are proving that, given equal opportunities, they can succeed in any career.
"A woman probably will not need a career; she can get a job to fill in whenever necessary."	The U.S. Women's Bureau reports that nine out of ten women will work at some time in their lives, and that a majority of these women will work because of pressing economic need. Furthermore, a declining number of women leave work for marriage and children. Among those who do leave, a majority return to work when their children are in school. Even with a break in employment, the average woman worker has a worklife expectancy of 25 years; many work up to 45 years.
"Women can't handle science and technology jobs; these are men's fields."	Many women today are demonstrating that women can and do handle jobs at all levels in science and technology. Only rarely are the qualifications needed for a job limited to one sex or the other. In our mechanized world, physical strength is of little importance in most jobs. Mental ability, creativity, curiosity about "why," interest in problem solving, and perseverance are some important characteristics needed for careers in science and technology. Both men and women possess these traits.
"Women don't want responsibility on the job."	Women have held positions of responsibility for centuries. They have been rulers, politicians, scientists, inventors, writers. Many have held responsible positions in less visible, inadequately rewarded, traditionally female areas such as nursing and education. When given the opportunity, women, like men, do cope with job responsibilities in addition to personal or family responsibilities.

ABOUT WOMEN IN SCIENCE AND TECHNOLOGY?

MYTH	REALITY
"Employers will not hire women in science and technology fields. If they do, they won't promote them."	Employers today are recruiting and hiring women, opening training programs to them, and moving them into positions of responsibility. Federal affirmative action requirements have forced some companies, educational institutions, and public and private agencies to change hiring and promotion procedures. Many employers, recognizing what women scientists and technologists have to offer as employees, are changing their hiring and promotion practices voluntarily.
"Women have achieved little in science and technology."	Everyone has heard of Marie Curie. But how many people know about the scientific and technological achievements of Mary Somerville, Emmy Noether, Lillian Gilbreth, or Sophie Germain? Many women, including those pictured in this book, have had successful and meaningful careers in science and technology.

In the past, women who entered the field of science and technology did so against great odds. Frequently only exceptionally bright women could overcome the obstacles. Now these odds are changing. Women today do not need to be any brighter than men to succeed in these fields. Young women can look forward to exciting careers in all areas of science, engineering, and technology.

WHAT ARE THE CAREERS IN

A few years ago, careers in science and technology were often organized into neat lists which contained a minimum of overlap. Here are some common examples.

Engineers/Technologists
Aerospace engineer
Agricultural engineer
Architectural engineer
Civil engineer
Computer programmer
Draftsman/woman
Industrial engineer
Laboratory technician
Mechanical engineer
Radio broadcast technician

Life Scientists
Biologist
Botanist
Ecologist
Geneticist
Pharmacologist
Physiologist
Zoologist

Conservationists
Forester
Range manager
Soil conservationist

Earth Scientists
Geologist
Geophysicist
Meteorologist
Oceanographer

Mathematicians
Actuary
Applied mathematician
Statistician

Physical Scientists
Astronomer
Chemist
Nuclear physicist
Physicist

The *Occupational Outlook Handbook* (see reference on page 16) describes careers that have been organized into similar lists. Careers in these areas are still very important in our society.

However, something new is happening on the career scene in science and technology. New job titles are rapidly emerging from combinations of old ones. As the needs of society grow more complex and as scientific knowledge expands, careers combining training and skill in several scientific/technological areas are becoming increasingly common. For example, biochemists who work in medical research combine biology and chemistry. Psychophysiologists, skilled in psychology and physiology, deal with the effects of the mind on the body.

The old organizers (e.g., jobs in life science, physical science, engineering) are still a good way to begin thinking about careers. But don't let them limit your career exploration. If you are interested in several areas you have not seen combined before, talk to specialists in each field. Perhaps you can build an exciting career out of your own response to social needs.

Why are new job titles emerging in science and technology? Modern society's demands upon science and technology are increasing and changing. As soon as science answers some of our questions, we ask others. Answers to these questions frequently depend on knowledge of several fields. Can you speculate where the answers to these questions might come from?

- Can biofeedback and transcendental meditation be used to treat heart disease?
- Can we produce enough food to feed millions of people spread across an unevenly productive earth?
- Can we interpret the languages of whales and porpoises?
- Can science help social scientists build a better jail? Should it?
- As we increase our knowledge in genetics, are there ethical questions about the control of human development which must be answered?
- Can we develop insecticides and herbicides that will insure adequate crops but will not upset ecological balances?
- How can mathematics be applied to the study of tornadoes?
- Can extrasensory perception be explained by science?

Answers to some of these questions may come from people in careers that haven't yet been imagined. When you study science, engineering, or mathematics in college, you may be preparing for a career whose title does not yet exist. You may not know the exact name of the career toward which you are heading. The important thing is to get a good foundation in the basics upon which so many careers are built: science and mathematics.

SCIENCE AND TECHNOLOGY?

The activities of science are sometimes divided into *basic* and *applied*. *Basic* questions are concerned with understanding and acquiring knowledge about very fundamental aspects of the world, whether there is an immediate application for this knowledge or not. *Applied* questions are generally concerned with relating basic knowledge to the solution of human problems. Science and technology careers may be structured to deal primarily with one or the other; most involve elements of both.

Where do scientists and technologists work? They are employed in public and private industry, government, research laboratories, universities, schools, and private consulting firms.

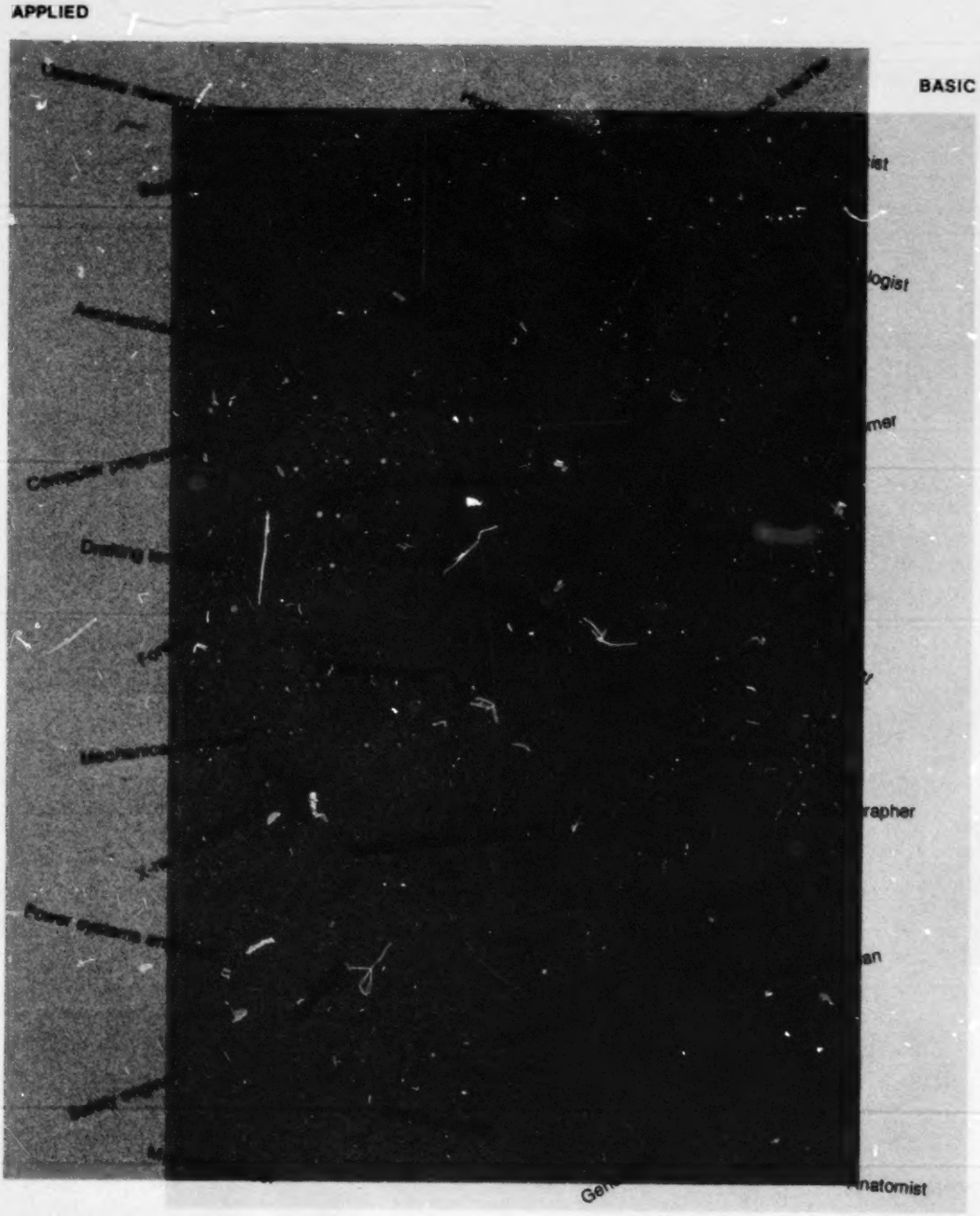

Photo by West High School, Iowa City

"Young women who are interested in their environment and who are inquisitive about the why's and how's usually become scientists."

"Gender doesn't matter. A scientist or technologist can be 100% feminine and do the job well."

Photo by The University of Iowa

Photo by The University of Iowa

"A sense of adventure and a desire to help humanity is what it takes for a career as a scientist or technologist."

"They do not have to be geniuses!"

BECOME SCIENTISTS AND TECHNOLOGISTS?

Photo by Monsanto

"My advice to women considering a career in science or technology is to have a large background of math and science courses, and to be prepared for work."

"Young women really do not differ from young men in their interest and curiosity in natural phenomena. They want to know what it is, why it works, or how it can be better. They enjoy solving problems."

"Engineering requires intelligence, stamina, and stubbornness, but it doesn't require genius in math or science."

"As a high school student, I had almost no interest in science. My acknowledged talent was writing and speaking. In college, I turned to science as a possible outlet for my talents as a writer."

Photo by The University of Iowa

Photo by The University of Iowa

"There are no 'typical' women in science careers. Their interests, capabilities, family life, and backgrounds are varied. The main thing they have in common is their ability to take a problem, define it, analyze the causes, study the effects, create or apply many possible alternatives, and finally come up with the optimal solution."

WHAT IS IT LIKE TO BE A WOMAN IN A PREDOMINANTLY MALE FIELD?

"I haven't found any drawbacks in being in a predominantly male field. I'd say you get special attention, not because you need it, but because you're something special and everyone is more willing to help you and to get to know you so you can stay in the career."

"At first you feel like a fish in a bowl. Then you become accepted if you do your job."

Photo by Institute of Hydraulic Research, The University of Iowa

Matilde C. Macagno is a member of the Institute of Hydraulic Research and a faculty member at The University of Iowa. As a mathematician and engineer, she has collaborated on the solution of problems of ship hydrodynamics, vortices, and compressible fluids, and is internationally recognized for her work. She serves as advisor to The University of Iowa Chapter of the Society of Women Engineers.

Photo by Georgia Pacific

Ann Forest Burns is an attorney/forester. "I handle problems requiring combined forestry and legal expertise, including litigation (trial practice), contracts, administrative regulatory problems with local and state governments, and lobbying efforts for and against laws affecting the timber industry."

"In a word, challenging. Goals and objectives are usually set high, but after the struggle and work, it is very fulfilling to reach those goals."

"It has its 'ups and downs,' but basically it is great to be rather unique."

"Wonderful! Even years ago, very little prejudice was evident in engineering. The men in science/technology are inclined to be intelligent, logical, and primarily interested in finding solutions to problems. Many men have helped me tremendously."

"Women in predominantly male fields are not looked upon very differently from women in other fields. Today's society is changing and is beginning to accept the fact that women are capable and vital in our workforce."

"I don't feel any less of a woman by being in a predominantly male field. In fact, there is often special recognition for a woman in such a field."

Photo by Frontier Airlines

In 1973, Emily Howell became the first female pilot for a scheduled U.S. airline. She began flight lessons in 1958, progressed to flight school instructor, and later became the only woman in Colorado to hold an FAA flight examiner rating. She is a copilot on Twin-Otters and Convair 580s.

ARE CAREERS COMPATIBLE WITH FAMILY LIFE?

"The choice to pursue a career need not preclude marriage, children, travel, or any other life style element. However, it does require realistic planning and flexibility on the part of all the people involved."

Photo by National Bureau of Standards

Chemist Sally Harrison collects water with a noncontaminating sampling device that she developed. Soon after this picture was made, Ms. Harrison took a maternity leave from her job to have a child.

"It's possible as an engineer or scientist to have your own consulting firm. It is also possible to stay out of the job market for a time and to come back, although some updating is often necessary."

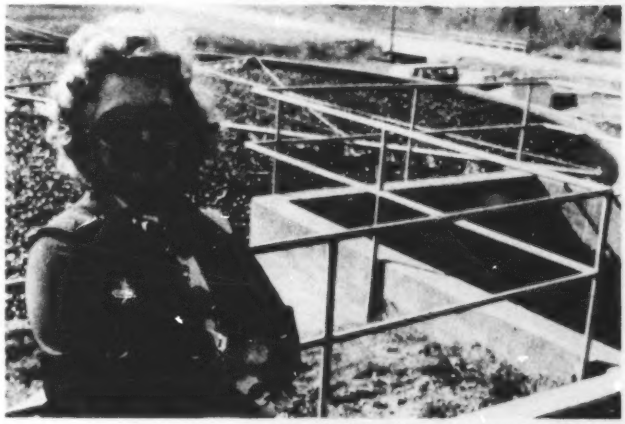

Photo by Mason and Hanger—Silas Mason Co.

Carol Paxton, senior scientist with a contracting firm, has had seven children during her 27 years as a mechanical engineer. During her spare time she has been a Girl Scout leader, Den Mother, Sunday school teacher, and PTA president.

"It must be an individual or couple's decision to have a family and not society's imposed custom. It is also the quality of time spent with children, not the quantity of time that is important."

"Careers in science/technology are like any other careers in terms of family situation. Both husband and wife must make sacrifices to achieve the type of family situation desired."

Photo by RCA Corporation

Aline Akselrad, physicist, has a son. She feels that for some working mothers, "leading a fuller life might help a woman to participate in the life of her husband and children in a more mature way."

CAN WOMEN REACH THE TOP?

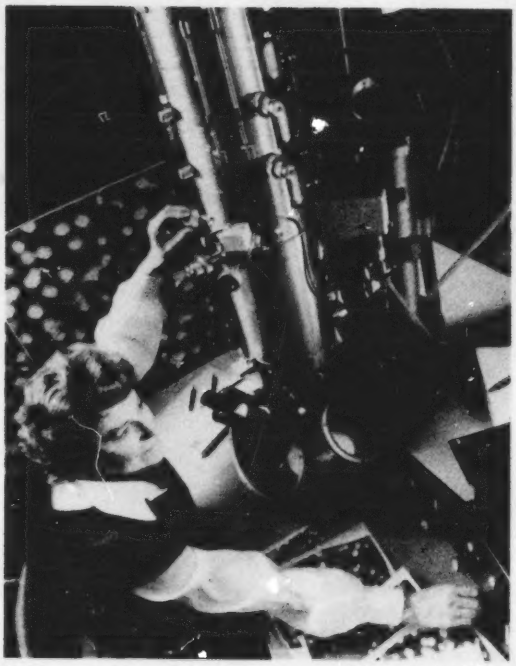

Photo by General Electric

Anne Turkalo is a research metallurgist interested in the structure-sensitive properties of materials. She uses the electron microscope in her work.

Photo by U.S. Department of Commerce

Betsy Ancker-Johnson is Assistant Secretary for Science and Technology in the U.S. Department of Commerce. She is a solid-state and plasma physicist with experience as a research scientist and engineer, an industrial executive, and a university professor.

Photo by National Aeronautics and Space Administration

Nancy G. Roman is Chief of Astronomy, Office of Space Science, National Aeronautics and Space Administration and is one of the nation's top scientists working in the space program. She is shown with a model of the Orbiting Solar Observatory.

Photo by 3M Company

Julianne Prager is a research chemist in organic chemistry. She has been supervisor of a central research laboratory of a major company and is now the Director of Corporate and Technical Planning and Coordination. She is also the elected chairperson of a professional fraternity of 3,300 scientists.

Photo by Radio Corporation of America

Dorothy Hoffman, chemical engineer, feels strongly that there "is absolutely no reason why a woman today should hesitate to pursue a career in science or engineering if that is her interest."

Photo from ***Women in Science*** *by Dinah Moché distributed by American Association of Physics Teachers*

Chien-Shiung Wu is a world famous experimental nuclear physicist. She is a professor of physics at Columbia University and President of the American Physical Society.

WHAT STEPS CAN YOU TAKE TO PLAN A SUCCESSFUL CAREER?

You probably have many ideas about careers you would like to consider.

The steps below can help you begin to explore some of the possibilities.

STEP 1

Take yourself seriously and decide to plan responsibly for your own future. Think about how you want your career to fit into the life you want. As you do, try to picture yourself in careers you may not have considered before, as well as in those you have already thought about.

STEP 2

Become an expert on yourself. Explore your interests and abilities. Ability tests and interest inventory results are one way to begin. See about these at the counseling center of your school or college. If you took the ACT or SAT, check your score report.

STEP 3

Find out about some of the many career opportunities which are open to you. Don't limit yourself to the outdated lists of "women's careers." Consider all possibilities. Consult the references listed on page 16. Look for up-to-date information about specific careers. Talk to women in science and technology careers. Learn about why they chose careers that in the past were unusual for women. Write to professional associations. Watch for TV shows, speakers, and conferences about these fields, too. You might become interested in a career you have never dreamed of, if you knew something about it.

STEP 4

Learn what is required to succeed in each of the careers you consider. Talk to counselors and advisors who are particularly interested in helping young women explore the full range of career possibilities. Ask them to help you find out about the kinds of training and education you will need. Write to colleges for program information.

STEP 5

Begin to prepare early for your career. Be sure to take courses in high school and college that keep your options open. Enroll in summer science programs offered by colleges and universities, while you are still in high school. These programs can give you some idea of what a career in science is like. Look for part-time jobs, summer employment, or volunteer activities to help you explore the world of work. Career options develop out of experience.

STEP 6

Don't restrict yourself as you begin to make decisions about your career. Consider *all* the careers that interest you and for which you can qualify. Women today and tomorrow will be leading full lives, engaging in a wide range of careers, enjoying a variety of family life styles, and helping as equal partners in the search for a better world.

STEP 7

Set your own goals and learn how to work for them. Keep a strong image in your mind of what those goals are. Work toward your goals with the idea of success in your mind. Many women are successful and happy in challenging and interesting careers. You can be too!

STEP 8

Take charge of making decisions for your own life and career. Assert your own ideas about what is the best career for you, whether it is in science or technology or some other area. You know best what your abilities and interests are. Others can help you explore your options, but don't let anyone else decide for you. Keep your dreams alive and make the best ones come true!

ARE YOU READY TO BEGIN?

Become an Expert on Your Own Career Choice

Can you say yes to all these statements?

	Check "yes" here	Not sure? See pages
I can imagine what it would be like in one or more careers in science and technology.		2-3
I understand that women's career options are expanding.		4
I understand some of the reasons why more young women haven't considered science and technology careers.		5
I can distinguish the *myths* about women in professional careers from the *realities*.		6-7
I have some ideas about new and exciting careers in science/technology.		8-9
I recognize characteristics of young women who are likely to become scientists or technologists.		10-11
I can imagine what it might be like to be a career woman in a formerly "male field."		12
I understand that women in science and technology have many different personal life styles.		13
I am planning, step by step, for a successful career.		15

Find Out More about Careers

Here are some leads to specific information about careers. Ask your librarian about them.

Carlson, Dale. *Girls Are Equal Too: The Women's Movement for Teenagers*. New York: Atheneum, 1973.

Hopke, William E., Ed. *Encyclopedia of Careers and Vocational Guidance*. 3rd ed. Vol. 1, *Planning Your Career*. Vol. 2, *Careers and Occupations*. Chicago: J. G. Ferguson, 1975.

Mitchell, Joyce Slayton. *I Can Be Anything: Careers and Colleges for Young Women*. New York: College Entrance Examination Board, 1975.

Occupational Outlook Handbook. Washington: U.S. Government Printing Office. Revised every 2 years.

Occupational Outlook for College Graduates. 1974-75 ed. Washington: U.S. Government Printing Office.

Seed, Suzanne. *Saturday's Child: 36 Women Talk about Their Jobs*. Chicago: J. Phillip O'Hara, Inc., 1973.

Leaflets, briefs, pamphlets describing occupations. Most libraries keep these materials in folders and file them alphabetically or according to groups of similar jobs.

Can you picture yourself in a career in science or technology?